Appendix E

2020 Draft Assessment Methodology Comments Received (3/21/20 – 4/21/20)

Comment #1 (via electronic mail 3/22/20):

Kevin: I appreciate the opportunity to comment on the Draft 2020 Assessment Methodology (Chapter 3) of the Water Quality and Pollution Control in Michigan, 2020 Sections 303(d), 305(b), and 314 Integrated Report (IR). Drain Commissioners in the State of Michigan oversee a vast area of surface water in County drains! As a matter of fact, 90% of the surface water in Monroe County is in manmade drains. This needs to be addressed in the IR. Drain Commissioners have more experience with storm water runoff than just about anyone else especially in Monroe County. What about “advanced drain technology”? Two stage drains are a must; but, property owners can’t afford to pay for them and the Drain Code doesn’t cover them to my knowledge. Maybe some Drain Commissioners are using them, I am not sure. This is a resource that cannot be overlooked! The Clean Water Act has been around for a long time and this isn’t the first Draft IR. Does this mean that County Drains are exempt? See what you can do about this. Fish are spawning in manmade drains. Storm events move substantial volumes of water down these drains. Periodic cleaning of the drains has an impact on water quality downstream. Maintaining the drains would pay big dividends to stop erosion and control TMDLs. Richard Micka

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Comment #2 (vial electronic mail, 3/33/20):

Kevin -

Could this year's Integrated Report, please, include an explanation of how it is that Saginaw Bay, with the Saginaw River, can be designated as a Great Lakes Area of Concern, but not be included on the list of Impaired Waters in the Integrated Report?

I realize that these concepts are addressed by different legislative and administrative processes. However, as a member of the Public Advisory Council for the AOC, I am at a loss to answer questions from local citizens and public officials about that.

Thanks for any insight you can provide for us.

Bill Wright, Vice Chair
Partnership for the Saginaw Bay Watershed

Comment #3 (via electronic mail, 3/24/20):

Sir,
It is truly bothersome that all our waters are unacceptably PCB contaminated and we are still misplacing our hope in the TDML process. Air transport is within a hemispheric ecosystem. There is no way that applying the TDML approach in a small region will have a significant affect on our waters.

Please pass the ball to the State Department and insist that they negotiate banning in what was once the "developing world," but is now our unregulated supplier of chemicals and manufactured goods.

Appendix E

I think that I offered the attached comments in 2016 (*Attachment follows*). Things have not changed. Please read carefully this time.

Respectfully,
Melvin J. Visser retired engineer

(see Attachment, following 13 pages):

TDML Regulation and POPs:

Oil and Water?

M.J. Visser April 2016 vissermel@hotmail.com

Introduction & Summary:

The intent of the Clean Water Act is to bring all waters into conformance with water quality goals. The drafters of the act recognized that there could be a condition in which all laws and regulations were followed and a water body still would not meet the desires of the act. In this case, the Total Daily Maximum Load (TDML) that the water body could accept and still achieve water quality compliance would be calculated. The EPA would then apportion that daily load amongst sources to the water body. The TDML concept is elegant in its simplicity and certainly appears to be just in its implementation. However, if there are major sources to the water body that are not under control of the EPA's regulation, apportioning the TDML to sources under the EPA's jurisdiction and ignoring major sources outside EPA's jurisdiction is a futile activity.

Global pollutants such as mercury, and the POPs (Persistent Organic Pollutants) such as PCBs and pesticides sourced to our waters through the air are currently above CWA target levels in Great Lakes. As we achieve zero sourcing from within our borders, our waters will reach equilibrium with global or hemispheric inputs of these pollutants. For mercury, PCBs, toxaphene, and chlordane, continuing global use continues to keep our waters non-compliant. For these pollutants, applying the TDML concept will not result in compliance.

Conclusions:

- Our Great Lakes are not meeting CWA target levels for mercury, chlordane, Lake Superior toxaphene,[1] and PCBs.
- Contamination levels of the persistent organic pollutants; chlordane, LS toxaphene, and PCBs, have stagnated, or may be slightly increasing since 2000.
- We continue to expend resources under the TDML to address insignificant sources of PCBs in hopes of affecting Great Lakes contaminant levels.
- Addressing PCBs through the TDML will do nothing for chlordane.
- Addressing PCBs through the TDML will do nothing for Lake Superior's toxaphene.
- Addressing PCBs through the TDML has been shown to be addressing only a small fraction of the source of PCBs to water bodies covered under the CWA.
- Our fish and those consuming them will not benefit from TDML activity.
- Our regulatory and health agencies are now sampling smaller fish to reduce toxicity.
- Another devious method employed to reduce fish toxicity and "show progress" is to use less sensitive assays.
- The above methodology has been so successful that the EPA no longer assays fish for toxaphene.

[1] Lake Superior toxaphene is a very unique case. See my book, "Cold, Clear, and Deadly: Unraveling a Toxic Legacy" MSU Press 2007 for a complete description of how Lake Superior's largest source of toxicity was "paper abolished" by the FDA and Michigan protectors of public health.

- We are not on a path to “fishable” Great lakes.
- Our current path needs to be changed and the global problem needs to be faced and addressed globally, not locally. Our Great Lakes and Earth’s oceans cannot be sacrificed for political correctness to the current polluters now manufacturing our goods.
- The USEPA, as a federal enforcement agency has done all it can to help us.
- They should be thanked and dismissed.
- Our Great Lake waters, the waters of the Arctic, and all the oceans are unnecessarily toxic. They are begging for a new band of stewards who can address global issues.

Our History of POPs Pollution and Regulation

In the Beginning:

The understanding of the flow of contaminants to the Great Lakes at the time of the implementation of the Clean Water Act was that contaminants such as PCBs were discharged from use or treatment facility points and flowed through watersheds and into our Great lakes. If they were spilled onto the ground, they were washed into streams, or rainwater would percolate them into groundwater that eventually flowed into streams and into the Great Lakes. Once into the Great or other lakes, PCBs would be buried in sediments.

One very serious aspect of PCB history that is currently lost on the current generation of regulators and environmental scientists is the disposal of PCBs. In the post WWII era, memories of wartime shortages were a part of everyone’s psyche. Waste was minimized, recycled and reused. We had not yet entered the disposable society. Waste liquid PCBs were collected as a part of the “waste oil” business. The terminal use of “waste oil” was a dust suppressant on our millions of acres of gravel roads and parking lots. When used as “cutting oil” in machine tooling operations, a major use of PCBs, the exiting water and PCBs flowed into a “UOP Separation Tank” where the oil was separated out. The oil was then used on the nearby parking lot, or was sold to a waste oil collector.

In the 1970s, it became clear that PCBs were present at hazardous levels and had to be banned. DDT was banned in 1972 and its presence in the environment was decreasing. If PCB use was stopped, eventually these stable compounds would be buried in sediments and out of our environment.

The Success of Banning:

PCBs remaining in use after the 1978 banning were monitored, collected into safe areas, and eventually incinerated or if appropriate, low level wastes were placed into special landfills. Lake Michigan, a water body where lake trout were monitored, responded quickly to the banning. (Appendix 1a) The Great Lakes area instituted PCB controls before the 1978 national ban and by 1984 PCB levels in lake trout were at 20% of their peak level.

Fish consumption guidelines were initiated as a temporary measure. With banning, we thought that within a few years PCBs presence would diminish to acceptable levels and fish could be consumed without concern. By the early 1990s, it was becoming apparent that the rate of PCBs, and other POPs pollutants, decline was slowing and it would be a long time before we could eliminate fish consumption advice. Concentrations were leveling out and they were well above water quality guidelines. (Appendix 1b) Banning was not working. There had to be a source of these contaminants within the Great Lakes Basin.

Other POPs sources:

Remember, in the early 1990s our scientific understanding was such that PCBs and other POPs contamination within the Great Lakes Basin had to come from the Great Lakes basin. PCBs were considered to be non-volatile, and there was no way that they could transport through the air like acid rain. The IJC (International Joint Commission,) through the USEPA, Environment Canada, and their State and Provincial partners championed Zero Discharge, Clean Sweep, and Virtual Elimination programs to

clean the basin of POPs sources, but pollutant concentrations refused to decline at an appreciable rate. Therefore, there had to be a source within the basin.

Passionate environmental activists of the time knew in their hearts that industries of the Great Lakes Basin had to be the continuing source. Environmental scientists of the era realized that all of the offending POPs contained chlorine. A simplistic assumption that chlorine use by industry and municipalities was running rampant, accidentally forming the POPs pollutants, and maintaining the POPs levels in the Great Lakes was made. Creating "unleaded" gasoline had recently solved the problem of lead contamination from gasoline. Environmentalist activists and scientists postulated that removing chlorine use from the Great Lakes basin would be the best way to remove POPs sources from the Great Lakes Basin. There was absolutely no scientific basis for this theory, but the passionate activists of the time successfully got the IJC to accept a proposal to ban chlorine in the Great Lakes Basin at their 1991 meeting. The proposal was hotly debated for the two years prior to the IJC's 1993 meeting where the EPA and Environment Canada rejected it because there was "insufficient data to justify the ban of chlorine." The theme of the 1993 IJC meeting was "Thinking Basinwide." At this time, they and their partners strongly believed that the Great Lakes Basin was an ecosystem and pollutants respected its boundaries.

In the mid 1980s, Canadian researchers studying PCB contamination of human milk in southern Ontario were frustrated by its slow rate of decline. They went to Broughton Island, NWT, now Qikiqtarjuaq, Nunavut, an Inuit hamlet above the Arctic Circle to obtain a "pristine" background sample. They were shocked to find PCB levels at eight times those in Ontario. Follow up research found even more toxicity present as toxaphene and chlordane, pesticides that had absolutely no Arctic use. How were these chemicals getting thousands of miles from their use points? The initial scientific opinion was ocean currents carried them, but researchers wanted to be certain. The Arctic Monitoring and assessment Programme (AMAP) an eight circumpolar nation effort was initiated to study several types of Arctic pollution, including POPs.

Meanwhile, the USEPA and NAFTA funded environmental scientists were beginning to realize that the air could be a transport mechanism for PCBs and other POPs. By the mid 1990s the EPA was describing a Great Lakes Airshed. They published a North American map with the Great Lakes at the center surrounded by concentric potato-shaped rings denoting time of travel to the Great Lakes. All of North America's air was within five days of dumping its toxic load into the Great Lakes. Our lakes were like a magnet for these pollutants. Under this model, zero discharge from all of NAFTA's trading partners, The U.S., Mexico, and Canada, was necessary to clean up the Great Lakes.

To determine where the PCBs were really coming from and going to, the EPA launched a mass balance study of Lake Michigan in 1994-5. This excellent research effort drastically changed the ideas of PCB transport, (Appendix 2) or more properly, should have changed how we thought.

Going into the Lake Michigan Mass Balance Study (LMMB), it was thought that PCBs flowed into Lake Michigan through its watersheds and rivers. PCBs were removed from the lake by settling out in sediments that would be consolidated with time and effectively buried. The LMMB found that the flows through the air were much greater than the flows through water, and were seasonal. The largest flow by far was summertime venting of PCBs into the air. Winter flow into the lake was the next largest vector. In the more contaminated Green Bay, the relative venting was greater. Lake Michigan's major route of getting rid of its PCBs was by venting them into the air! The amount sequestered into consolidated sediments was about equal to the amount flowing down from watersheds. During the study year, the net amount lost was greater than the amount of PCBs dissolved in Lake Michigan's water column. There was a very large inventory of PCBs in the suspended sediments. These sediments were in equilibrium with the water column and acted like a sponge, taking up PCBs in the winter and releasing them during the summer.

Now it became obvious that during the PCB use period, much of PCB transfer to our Great Lakes was through the air from its major waste disposal as road oil. Once local air was cleared, venting from the lake occurred. This venting was rapid initially, and by 1995 was slowing down as Lake Michigan was approaching equilibrium with the globally supplied air levels. This free transport of PCBs through the air explained how Lake Superior, a large lake with few watershed sources became contaminated.
Transport of PCBs through the air was investigated on several fronts. PCB levels in the air over Bermuda were found to have remained rather constant and were higher when the wind was blowing from Africa.[2] In 1993, Great lakes researcher, James P. Ludwig and others, went to islands in the western Pacific where albatrosses were contaminated with PCBs and DDT.[3] They expected to find PCBs from WWII military use as the source, but determined that the PCBs were coming through the air from Asia. This research was repeated a decade later and concentrations of contaminants had increased 130-360%. [4] At the turn of the century Bermuda's air remained constant, while the air east of Asia was transporting increasing amounts of PCBs. China was rapidly developing at the time and became the world's largest producer of pesticides in 2004, and the largest producer of chemicals in 2011.
The AMAP research effort was reported out in 1998. PCB contamination was found all across the Arctic. Studies of sediments of large clear North American lakes showed increasing levels of PCBs with decreasing latitude, right down to the Great Lakes. AMAP scientists studied POPs contamination from around the world and deduced that these semi-volatile chemicals traveled through the air and distributed around the hemisphere of their release according to their volatility. (Appendix 3) Volatile POPs such as Lindane and hexachlorocyclohexane move rapidly toward the pole. In the Northern Hemisphere, PCBs spread out in the mid latitudes and diminish toward the Arctic. This trend is seen in the concentrations of PCBs in the Great Lakes in 2000, 28 years after local banning. (Appendix 1b) Toxaphene, very stable in cold clear waters is present and recalcitrant from Lake Superior north. Chlordane's presence is felt throughout the Great Lakes and latitudes to the north.
The amazing work of the LMMB and AMAP showed that PCBs and other POPs inhabit the hemispheric ecosystem they are released into and distribute within this ecosystem according to their volatility. Wherever used in the hemisphere, they will disperse to any point in the hemisphere unconstrained by watershed or national boundaries. For PCBs, this distribution will diminish to the north, but contamination levels are also affected by altitude. The cold mountain lakes will have more contamination than lakes at lower elevations at the same latitude. This elegant global distribution of the semi-volatile POPs was totally unexpected. It means that for any given area without local sources, water concentration will equilibrate to reflect the hemispheric use rate of the time and the hemispheric loss

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[2] Atmospheric Concentrations of Polychlorinated Biphenyls in Bermuda Sandra Y. Panshin, Ronald A. Hites *Environ. Sci. Technol.*, 1994, 28 (12), pp 2001–2007

[3] Persistent synthetic chlorinated hydrocarbons in albatross tissue samples from Midway atoll. Jones, P. D., D. J. Hannah, S. J. Buckland, S. V. Leatham, L. J. Porter, H. J. Auman, J. T. Sanderson, C. Summer, J. P. Ludwig, T. L. Colborn and J. P. Giesy. 1996. Environmental Toxicology and Chemistry **15**: 1793-1800.

[4] ALBATROSS SPECIES DEMONSTRATE REGIONAL DIFFERENCESIN NORTH PACIFIC MARINE CONTAMINATION.MYRA FINKELSTEIN et. al. 2006 by the Ecological Society of AmericaEcological Applications, 16(2), 2006, pp. 678–686Ó

rate. Total global use of a POP dictates its concentration in all waters remote from overwhelming sources, including the Great Lakes. Reducing PCB contamination can only be accomplished by reducing the rate of input to the ecosystem.

For PCBs, the major loss rate is tropospheric attack by the hydroxyl radical. (Appendix 5) To understand this chemistry, chloro-fluro-carbon (CFC) refrigerants and propellants were banned to protect the ozone layer. They contained only carbon-chlorine, and carbon-fluorine bonds and were stable in the troposphere. CFCs diffused into the stratosphere where they destroyed ozone. By replacing them with HCFCs, chemicals containing a carbon-hydrogen bond, they were attacked in the troposphere and kept from diffusing into the stratosphere. PCBs have carbon-hydrogen bonds and are subject to atmospheric destruction. The AMAP report states that the half-life of PCBs in air is up to 2 years and in water up to six years.

The next important manner in which PCBs are removed from the active environment is burial in sediments. In the LMMB (Appendix 2) the EPA found that 349 kg of PCBs were being buried in consolidated sediments during the 1994/5 study year. This is taking place in waters throughout the hemispheric ecosystem, fresh and salt waters alike. PCBs are slowly removed through biological reduction, and are known to metabolize at several levels of the food chain. If primary sources of PCBs are removed, PCBs will disappear from the environment; not before that time.

Several dangerous misconceptions concerning POPs source and fate have been noted in the research literature. One is that POPs are travelling to the Arctic as a sink. POPs travel toward the Arctic, but they get lost to atmospheric chemistry and sediments on the way. This degradation vs source supply interaction causes PCBs to diminish in concentration toward the Arctic. Our Great lakes PCBs are not going to migrate to the Arctic; the Great Lakes will always be much more contaminated than the Arctic. The Inuit consume high levels of POPs because they are eating seals that eat fish, and polar bear that eat seals. Another misconception is that “sediments” are now a “source” of PCBs. In the LMMB, the 349kg of PCBs sequestered in consolidated sediments is out of play. The “suspended sediments” of 1994/5 were a gigantic PCB sponge. In the summer, they were a source of PCBs to the water, and then the air, but in the winter they became a sink. In 1994/5 these suspended sediments were a net source; they lost PCBs. Today, with the PCB levels static or rising, the suspended sediments are now a neutral sponge or a sink. For an item to be a “source,” it has to contribute and therefore lose PCBs. It is very dangerous to think that suspended sediments and anything measurable in the dirt are sources. It will cause us to think that removing them is progress when it is not. Even more dangerous is to think that primary uses have been banned in the non-democratic and developing countries now doing the globe’s manufacturing.

The AMAP effort went on to create the voluntary global POPs banning agreement, the Stockholm Convention of 2001. Under the United Nations Environmental Programme, the priority of implementing the goals of the Stockholm convention was readjusted. Arctic concerns drove POPs banning. Arctic toxicity came from chlordane, toxaphene, and PCBs in that order. UNEP priorities were twisted into a focus on DDT and dioxin. The book, “***Northern Lights Against Pops: Toxic Threats in the Arctic***” **gives an excellent presentation of the development of the POPs banning agreement and the uncertainty of its implementation.** The UNEP has accomplished “paper action” toward banning the legacy POPs and other chemicals defined as POPs, but there has been no work to address the banning of PCBs, chlordane, toxaphene, or legacy POPs other than DDT. DDT banning is still a country-by-country decision and the Zika virus outbreak will probably bring its use back. Google “Zika virus DDT” to assess the current mood of threatened areas.

Appendix E

I have had the privilege of conversing with an EPA executive who was "observing" the Stockholm Convention negotiations at the turn of the century. Russia was at the table for months stating that it had banned PCBs. The Iron Curtain lifted a bit at that time and the Russians admitted that they were still using PCBs and would not address banning until at least 2025. I doubt if they are ahead of schedule. In talking with a Zambian (2008) who was part of the African group negotiating to maintain DDT for vector control, he was frustrated by the Asian and European countries that sent Africa equipment with PCBs and would not assist in their management or disposal. He acknowledged the continuing use of chlordane and that it would not be addressed, and knew nothing about toxaphene. An American university student described a UNEP internship where he spent time in Nairobi and Washington D.C. following their process of addressing POPs. He quit in frustration as nothing was happening. "They spent two weeks deciding how to table something" was his comment. A few years ago UNEP staffers tried to get the following question on the UNEP agenda; "Since the voluntary banning was agreed upon has the global use of PCBs increased, decreased, or stayed the same?" It was not addressed.

Unfortunately, it is commonly believed among environmental researchers that PCBs and the POP pesticides such as toxaphene and chlordane are globally banned, with PCBs being banned in the 1990s. (Appendix 4) The albatross research of 1993 & 2004 shows that Asia was increasing PCB emissions during this time. The POPs research community, led by governmental scientists, believes that the elevated levels in China's air are coming from their processing of "E-Waste" from western nations. This is highly unlikely, as PCBs were banned in 1978, well before the era of rapidly obsoleted electronics.

We are now living in a world where the science of POPs transport and fate is well understood and this understanding is contrary to the intent of laws and regulations promulgated before researchers had an understanding of the science. This is leading to actions by regulatory agencies that would be comical if they were not so serious and deceptive. The EPA wrote laws to protect the environment, attained regulatory power from them, and they WILL exercise this power.

One of the early attempts to exercise power over common sense was imposing TDML compliance on the Delaware River watershed. A Rutgers University assessment[5] stated "Wet, dry particle, and gaseous absorption deposition are estimated to contribute about 0.6, 1.8, and 6.5 kg year^{-1} ΣPCBs to the River, respectively, exceeding the TMDL of 0.139 kg year^{-1} by more than an order of magnitude." They went on to explain how more PCBs entered the watershed from rainwater flowing into tributary streams without PCB sources. Our U.S. regulators are not unique, the Swiss found 35 nanograms per liter in rainwater, or 2000x the water quality target. Controlling municipal treatment plants will not reduce POPs transport through the air. Expending effort so foolishly will only serve to keep us from addressing the real problem, continuing use in the hemisphere.

Here in the Great Lakes, the EPA has no cure for our POPs ills, but they will still invoke the TDML for PCBs as there are measurable blemishes of PCBs in the area. Chlordane is not mentioned, as there are no historical stains remaining. Its source is 100% from ongoing uses on other continents. Toxaphene, a major problem in Lake Superior, also has no local stains. Toxaphene is no longer assayed as the EPA employed less sensitive assays and assayed a different suite of Parlars to make it go away. Nobody

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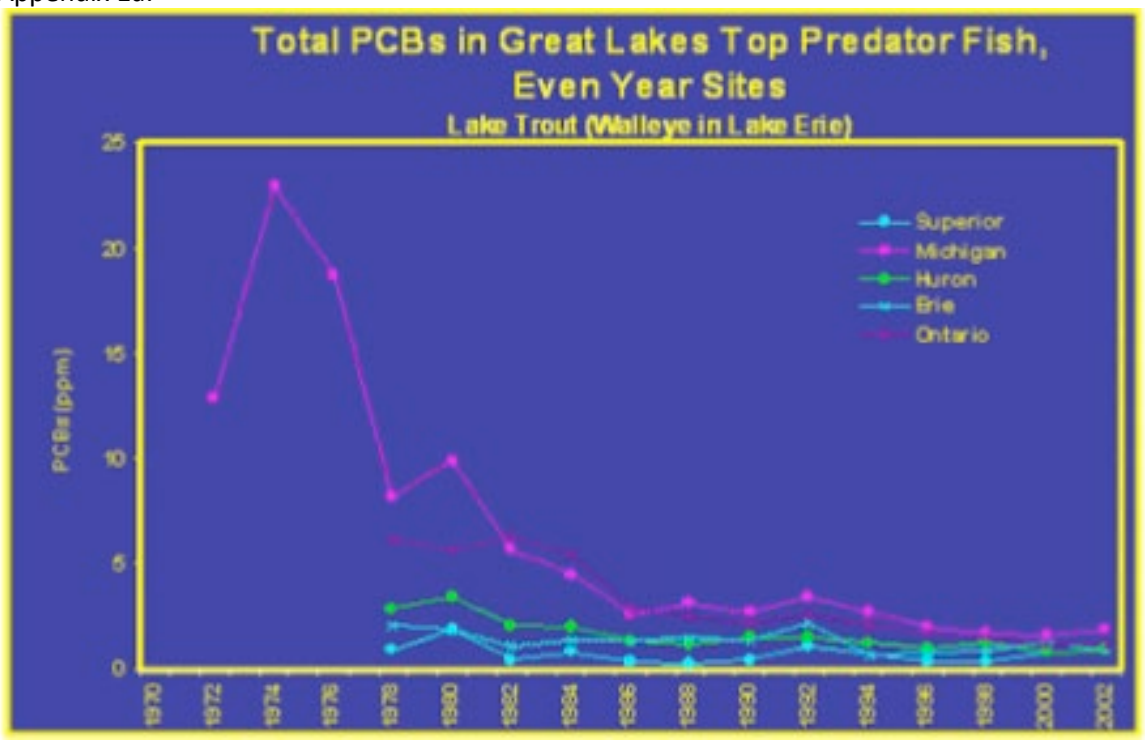
[5] **Direct and Indirect Atmospheric Deposition of PCBs to the Delaware River** Watershed Lisa A. Totten ,*† Maya Panangadan ,‡ Steven J. Eisenreich ,†‡ Gregory J. Cavallo ,§ and Thomas J. Fikslin §Department of Environmental Sciences, Rutgers University, 14 College Farm, Road, New Brunswick, New Jersey 08901 and Delaware River Basin Commission, 25 State Police Drive, West Trenton, New Jersey 08628 *Environ. Sci. Technol.*, 2006, 40 (7), pp 2171–2176 DOI: 10.1021/es052149m Publication Date (Web): March 4, 2006

knows what levels of toxaphene remain in Lake Superior. Addressing PCBs is a “feel good” measure as it gives the EPA the power of making grants for research and remediation and show the progress of spending money. The most affected people, the indigenous, are given trinkets of jobs and grants while regulators sample smaller fish and use less sensitive assays to show that their efforts are removing PCBs, chlordane, and toxaphene when they are not.
It is time to stop this charade. It may be politically correct to ignore the pollution of the countries we have banished our manufacturing to, but our waters and the waters of all oceans are suffering. The EPA does not have the power to address POPs sources and its flailing about to appear to be progressing is wasting resources, giving false comfort, and delaying remediation of a very serious problem of global health.

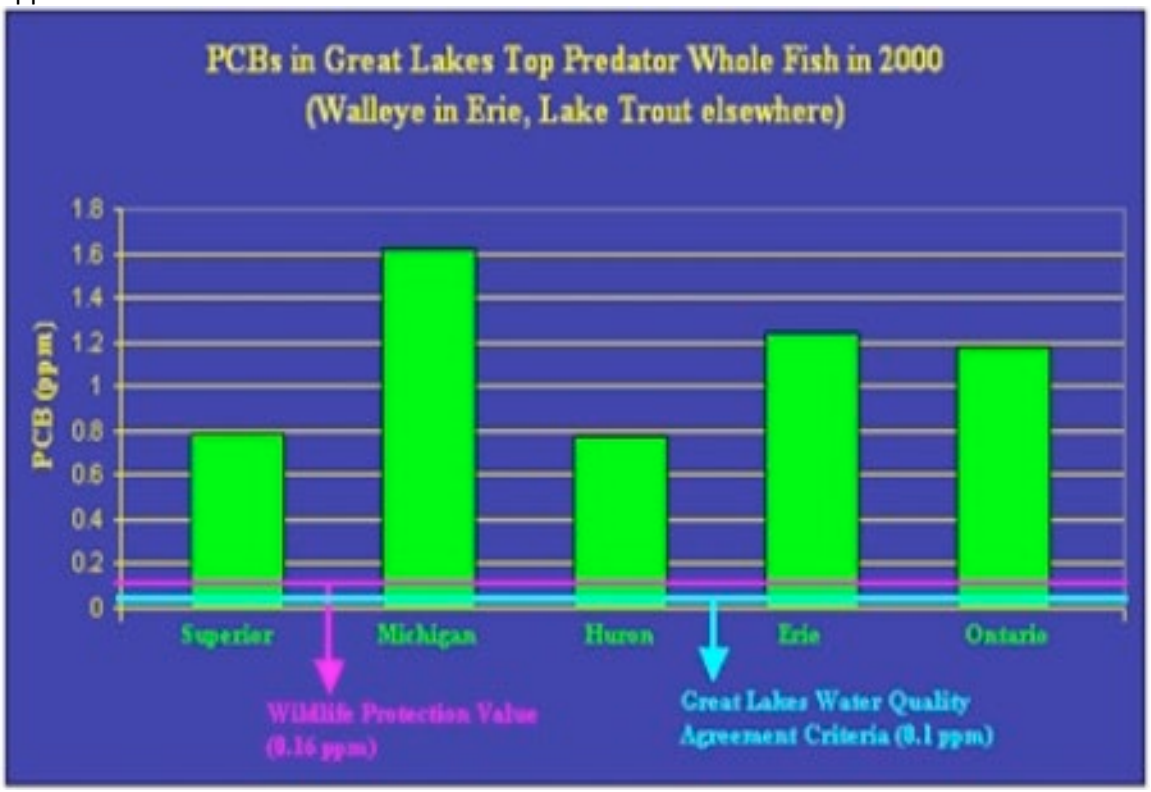
Current Status of Michigan’s TDML:
A Statewide TDML for PCBs was drafted for Michigan’s waters, other than the Great Lakes and connecting waters, and presented in January of 2013. A comment period was open until February 19, 2013. Michigan was the first state to submit a PCB TDML to EPA Region V in August of 2013. It is currently under review. The January draft can be found at:
http://www.michigan.gov/documents/deq/wrd-swas-tmdl-draftpcb_408124_7.pdf
The MDEQ sampling of carp fillets from unaffected lakes since 1984 (Appendix 6) shows the need for addressing waters without known and identified sources. The trend indicates the leveling off, and perhaps even a slight increasing, of PCB levels. The draft TDML recognizes gas phase transfer of PCBs from air to water as the dominant source of PCBs to these inland lakes. To achieve compliance, the draft TDML calculates that the concentration in air must be reduced by 94%. To reduce air concentration, sources to the air must be reduced. The draft TDML calculates that 45% of the PCBs in Michigan’s air come from within the state, and 55% from neighboring states. This calculation is based on land area and population density.
To accomplish Michigan’s share of reduction to the air, cleanup of legacy sources, restriction of landfill use, and regulation of PCB transport is recommended. Then, if neighboring states also comply, we will achieve compliance with water quality targets. Really?
My Little Secret: Air moves globally. Nearly a century of PCB use has equilibrated air and water all around our hemisphere, even the oceans. Continuing, or increasing, global use of PCBs is balanced by its losses to degradation and environmental sinks, keeping global air concentration rather constant. The little bit of difference we can make by reaming and cleaning one little dot on the hemispheric map will not have an effect on global air concentration. The only way to make progress is to attain global banning of primary uses. The USEPA, an agency charged with enforcing federal laws, even when the laws are scientifically outdated, cannot do that. They are only prolonging the agony. For the sake of our Great lakes and our health they need to be replaced by an agency that can make global progress.

Appendix E

Appendix 1a:

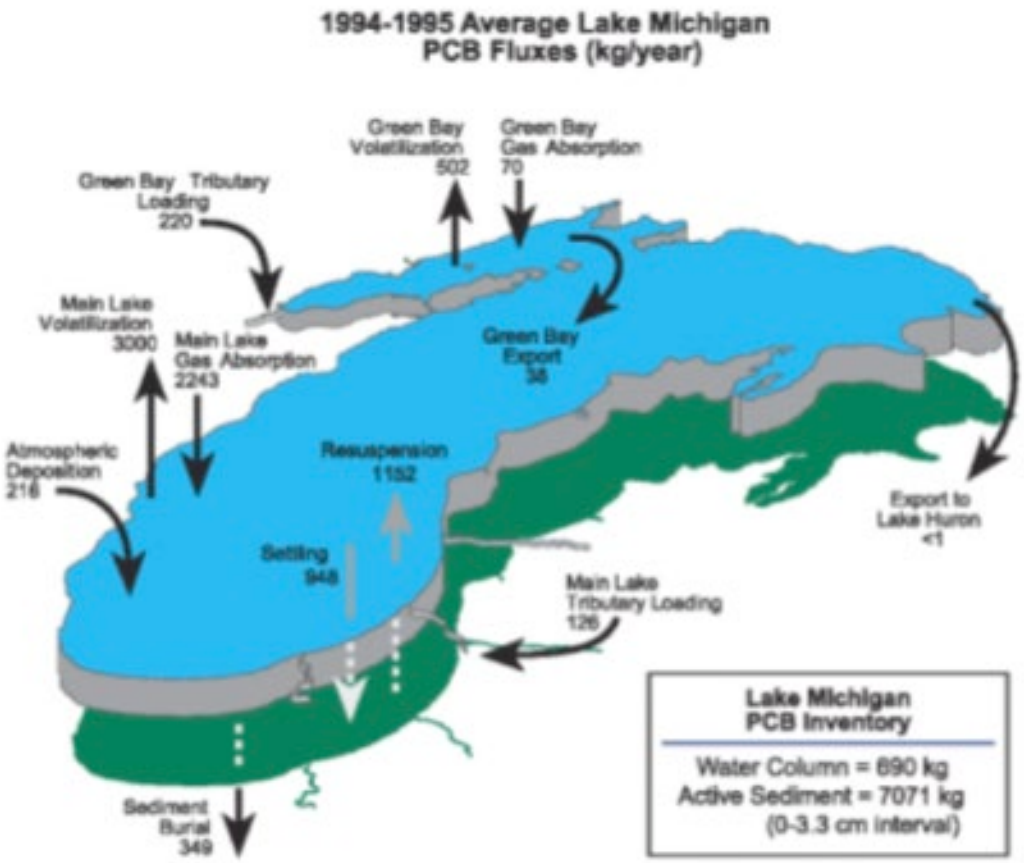


Appendix 1b:



Appendix 2: Lake Michigan Mass Balance (LMMB)

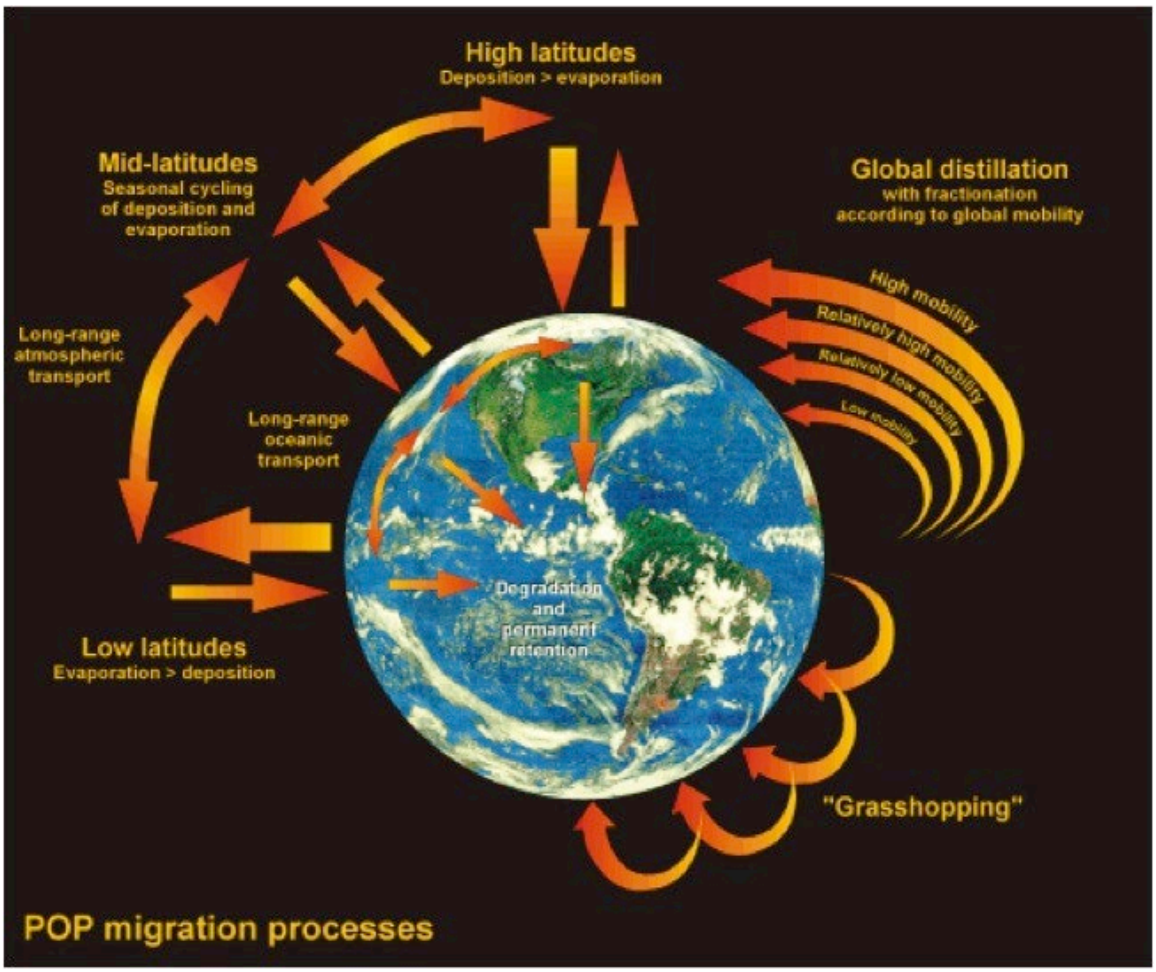
Appendix E



(See this mass balance graphic at http://www.epa.gov/glnpo/lmmb/results/loadpcbs.html

Appendix 3: Hemispheric Distribution of POPs

Appendix E


High latitudes
Deposition > evaporation
Mid-latitudes
Seasonal cycling of deposition and evaporation
Global distillation
with fractionation according to global mobility
High mobility
Relatively high mobility
Relatively low mobility
Low mobility
Long-range atmospheric transport
Long-range oceanic transport
Degradation and permanent retention
Low latitudes
Evaporation > deposition
"Grasshopping"
POP migration processes

Appendix E

Appendix 4:

Spatial and Temporal Variability in PCB Levels in Lake Trout (*Salvelinus namaycush*) in Lake Superior from 1995 to 2013

Hongyi Lin, Noel R. Urban, Judith A. Perlinger
Department of Civil and Environmental Engineering, Michigan Technological University

♦ Introduction ♦

Polychlorinated biphenyls (PCBs) are a series of synthetic organic compounds that were widely used as dielectric fluid, coolant and in many other industrial applications during early and middle 20th century. The estimated cumulative global PCB production was over 1.3 million tons before the global ban in early 1990s, and one third of production had entered the environment through both use and disposal[1]. Once released into the environment, PCBs persist for a relatively long period of time and cycle between water, air and soil due to their high chemical stability. PCBs also bioaccumulate in food webs. As a result, in Great Lakes area, fish consumption advisories exist and the government established several programs to monitor the PCB levels.

♦ Objective ♦

The ultimate objective is to evaluate when fish in Lake Superior will be safe to consume in unlimited quantities. To that end, this project evaluates quantitative relationships between PCB concentrations in lake trout and predictor variables including:

- Location
- Time
- Fish characteristics (length, lipid content, gender…)
- Analytical method (fish sample type, PCB measurement method…)

Figure 1. Photo of lake trout. Lake trout is a good PCB indicator since it is top predator fish and has high abundance in the Great Lakes.

♦ References ♦

[1] Breivik, Knut, et al. "Towards a global historical emission inventory for selected PCB congeners—a mass balance approach: 1. Global production and consumption." *Science of the Total Environment* 290.1 (2002): 181-198.
[2] Bhavsar, Satyendra P., et al. "Are PCB levels in fish from the Canadian Great Lakes still declining?." *Journal of Great Lakes Research* 33.3 (2007): 592-605.
[3] U.S. EPA Central Data Exchange - https://cdxnodengn.epa.gov/
[4] Michigan Department of Environmental Quality, Fish Contaminant Monitoring Program Online Database - http://www.deq.state.mi.us/fcmp/

♦ Methods ♦

Figure 2. Fish sample sites. U.S. EPA and Michigan DEQ have only two and one sites, respectively. Both Minnesota and Wisconsin DNR have over 10 sample sites.

We collected fish sample data from U.S. EPA, the states of Michigan, Minnesota and Wisconsin. Then we used SAS to perform statistical analysis:

- Multiple linear regression analysis using fish length, time and lipid content as independent variables.
- Spatial variability: ANOVA test of fish length and PCB levels among five data sets in 1995/1996 and 2000/2001.

♦ Results ♦

Regression summary

Data source	Predictor variables	Slope (p value)
EPA KEW	Year	-9.80 (0.0016)
	Fish length	1.12 (0.0038)
EPA API	Year	NS (0.9636)
	Fish length	3.09 (< 0.0001)
MI DEQ	Year	NS (0.3730)
	Fish length	0.67 (0.0132)
	Lipid content	NS (0.4170)
MN DNR	Year	NS (0.1047)
	Fish length	1.36 (< 0.0001)
	Lipid content	NS (0.7760)
WI DNR	Year	-12.1 (0.0438)
	Fish length	3.15 (< 0.0001)
	Lipid content	NS (0.7249)

Figure 3. Multiple regression analysis summary by sites. NS means not significant ($p > 0.05$). Fish length is always a significant factor while lipid content never is. Significant temporal trends exist in only 2 of 5 data sets.

Spatial variability

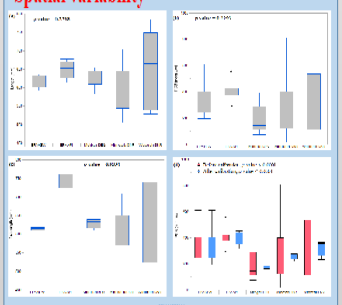


Figure 4. ANOVA test results. (a)(c) fish length of 1995/1996 and 2000/2001, respectively; (b)(d) PCB levels. (d) has a calibration by fish length, assuming that all five locations have the same fish length. Both fish length and PCB levels have little differences within the lake in 1995/1996, while PCB levels vary significantly among sites in 2000/2001 whether fish length is the same or not.

Temporal variability

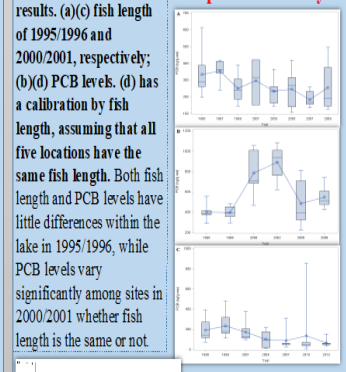


Figure 5. Temporal trends of PCB levels sorted by datasets. Graph A-E are EPA Keweenaw Point (EPA KEW), EPA Apostle Islands (EPA API), Michigan DEQ, Minnesota DNR and Wisconsin DNR, respectively.

PCB measurement methods

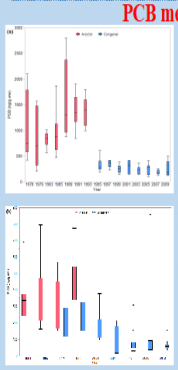


Figure 6. Historical PCB levels: (a) EPA Keweenaw Point from 1978 to 2009; (b) Michigan DEQ from 1991 to 2013. Both U.S. EPA and Michigan DEQ changed PCB measurement methods from Aroclor to congener in 1995 and 1996, respectively.

♦ Conclusions ♦

- Contrary to previous studies[2], lipid content was not a significant predictor of PCB concentrations in lake trout in any of the datasets. Thus further research is required.
- A positive relationship between PCB concentration and fish length was observed in all data sets as has been reported previously.
- A trend with time exists at most, but not all sites. Actually, at all sites, there has been no statistically significant change in PCB levels since 1995 when compared with the quick decline in 1980s and early 1990s. Some recent small oscillations could be attributed to different fish length.
- For some years (1995/1996), PCB concentrations have little differences across several locations within the lake. However, spatial variability is evident in some other years (2000/2001) even though PCB levels has been calibrated by length, possibly a result of different food webs.
- Compared to historical PCB levels, the sharp decrease in 1995 can partly be attributed to the alteration of PCB measurement method since then.

♦ Acknowledgement ♦

I am grateful to staff from US EPA, Michigan DEQ, Minnesota DNR and Wisconsin DNR, who provided the original fish sample data.

Appendix 5:

Appendix E

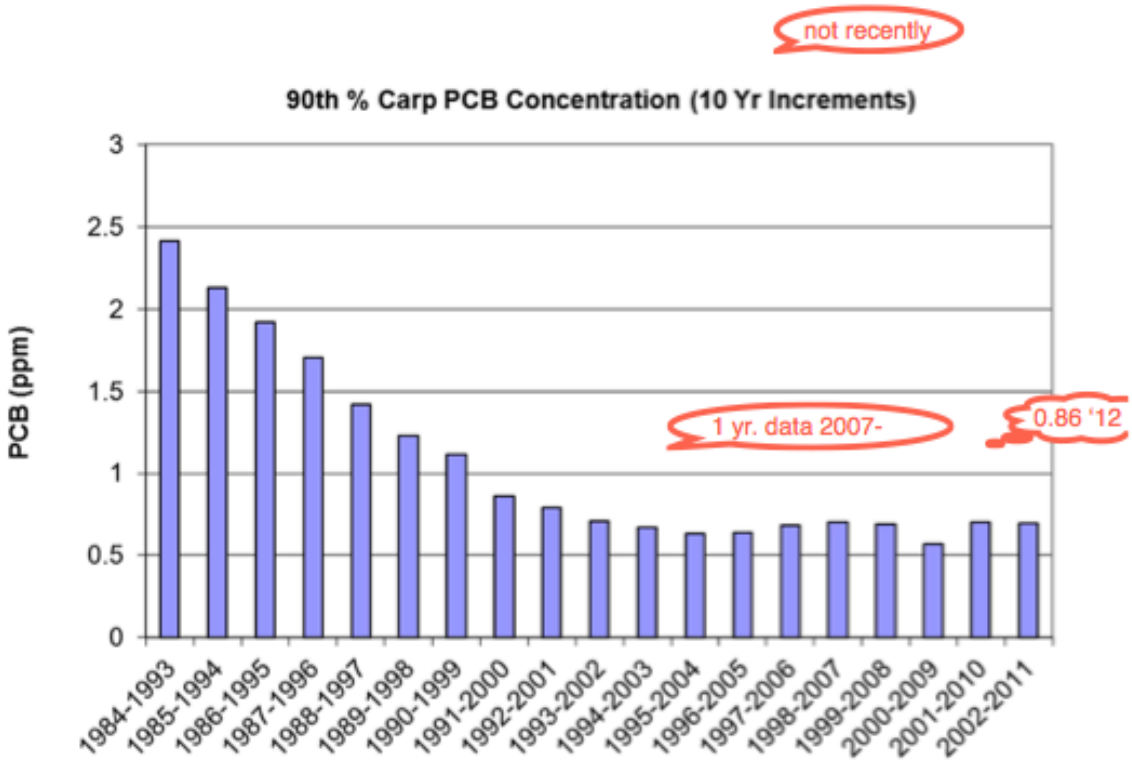
Half-Lives from AMAP 1998 Table 6-A1

Polychlorinated biphenyls (PCBs)

Common Name	Half-Life Air	Half-Life Water
tri-chlorobiphenyls	3 weeks	2 years
tetra-chlorobiphenyls	2 months	6 years
penta-chlorobiphenyls	2 months	6 years
hexa-chlorobiphenyls	8 months	6 years
hepta-chlorobiphenyls	8 months	6 years
octa-chlorobiphenyls	2 years	6 years
nona-chlorobiphenyls	2 years	6 years
PCB 28 2,4,4'-Trichlorobiphenyl	3 weeks □	2 years
PCB 52 2,2',5,5'-Tetrachlorobiphenyl	2 months □	6 years
PCB 101 2,2',4,5,5'-Pentachlorobiphenyl	2 months □	6 years
PCB 110 2,3,3',4'.6-Pentachlorobiphenyl	2 months □	6 years
PCB 153 2,2',4,4'5,5'-Hexachlorobiphenyl	8 months □	6 years
PCB 171 2,2',3,3',4,4',6,-Heptachlorobiphenyl	8 months	6 years

Appendix E

Appendix 6. From the MDEQ Annual Report:
Red comments are mine from examining the DEQ raw data sources. In recent years, annual values are plotted, not 10 year averages as the title indicates.



Estimated 90th percentile PCB concentrations in standard lipid carp from inland waters of Michigan for consecutive running 10-year periods.

How are we doing? Good overall; Fair in recent years

Comment: PCBs have been banned from open use for 30 years. Point source discharges have been controlled, and several sediment remediation activities for PCBs have been completed. The rate of change in recent years has declined, which is a reflection of the ubiquitous nature of PCB in the environment, its slow degradation rate and the global transport of PCB once it is released.

Appendix E

Comment #4 (via electronic mail, 4/17/20):

Dear Mr. Goodwin
The U.S. Environmental Protection Agency has conducted a review of the Michigan Department of Energy, Great Lakes, and Environment (MI EGLE) draft 2020 Integrated Report Assessment Methodology, which was on public notice from March 21, 2020 to April 21, 2020. Please find below our comments on the draft Assessment Methodology. We appreciate that MI EGLE has taken significant steps to refine its methodology for assessing water quality impairments in response to EPA recommendations. We look forward to continued discussions to ensure MI EGLE's Assessment Methodology supports full assessment of Michigan's waters. Thank you for the opportunity to review this draft Assessment Methodology. Please let me know if you have questions regarding our comments.
Jim Ruppel
EPA Region 5
Water Division

U.S. Environmental Protection Agency Comments to the
Michigan Department of Energy, Great Lakes, and Environment (MI EGLE)
regarding Draft 2020 Assessment Methodology
April 17, 2020

1. As stated in EPA's previous comments on the State's draft Assessment methodologies, EPA remains concerned that the threshold levels Michigan uses for listing determinations for "Warmwater Fishery and Coldwater Fishery, and Other Indigenous Aquatic Life and Wildlife" are at levels which may not fully identify impairment. MI EGLE has agreed that the current thresholds need to be evaluated. Michigan has been working with EPA and EPA's contractor to evaluate the macroinvertebrate index. This work should be completed in 2020. EPA asks that the State use this new information to develop the 2022 list.

2. Page 4 of the draft Assessment Methodology states: "Michigan uses the principle of independent applicability when making a support determination for each designated use for each water body." However, on page 10, Section 3.5.2.1 "Fish Community," the document states "Data on indicator species absence, while difficult to quantify with ultimate certainty, will be considered in a weight-of-evidence approach from a number of proven sources such as creel data, fish community sampling , . . ." Then, on page 12, Section 3.6.1.2, "Water Column Nutrient Concentrations," the document states: "For inland lakes, various data are useful in a 'weight of evidence' approach . . . ." The draft Assessment Methodology should explain how these statements referencing a weight of evidence approach reflect the principle of "independent applicablitiy," as EPA policy states.

3. Regarding the "Public Water Supply Designated Use" on pages 25-26 of the draft Assessment Methodology, we recommend that MI EGLE look at the public water supply use assessment methodologies that Ohio (https://www.epa.ohio.gov/dsw/tmdl/OhioIntegratedReport#123166646-2002) and WI (https://dnr.wi.gov/topic/SurfaceWater/Assessments.html) have developed for

cyanotoxins, especially now that MI EGLE has recently begun sampling for cyanotoxins in surface waters used for drinking water. In addition, we recommend that MI EGLE consider updates to the section on “Total Microcystins,” for example by removing the following language:

> Although the presence of microcystins in source water may necessitate additional treatment from a SDWA program standpoint, the link between that need and the presence of total microcystins in source water that indicates something unnatural and caused by a pollutant may not be clear in many cases. . . .

We are unclear what this language means and do not believe it would be appropriate to wait to determine that something is “unnatural and caused by a pollutant” before making an impairment decision based on available water quality data that could help protect public health.

Appendix E

2020 Final Draft Integrated Report Comments Received (6/26/20 – 7/27/20)

Comment 1 (via electronic mail, 7/27/20)**:**

MICHIGAN ENVIRONMENTAL COUNCIL

GREAT LAKES

July 27, 2020

Kevin Goodwin
Michigan Department of Environment, Great Lakes, and Energy
Water Resources Division
P.O. Box 30458
Lansing, Michigan

RE: 2020 Draft Integrated Report Comments

Mr. Goodwin,

Thank you for the opportunity to comment on the Draft 2020 Integrated Report. The Michigan Environmental Council and the Great Lakes Environmental Law Center are committed to the health of the Great Lakes and all Michigan residents. We appreciate the effort of the Division in developing this important report. The following summarize high level concerns and questions in the Draft Integrated Report.

Lake Erie

The Integrated Report notes the significance of cyanobacteria blooms in Lake Erie, pointing to the Great Lakes Water Quality Agreement as evidence that EGLE is taking this problem seriously. In 2015, a Task Team organized under the Great Lakes Water Quality Agreement set the load targets of 40% reductions in total phosphorus entering the western basin of Lake Erie by 2025 with an interim goal of 20% reductions by 2020. To date, EGLE has pursued these goals through a "collaborative process," and has avoided developing a TMDL. Unfortunately, the collaborative process failed to achieve the 2020 interim targets and appears unlikely to meet 2025 goals.

Unfortunately, these targets are appearing to be unattainable through the current collaborative process. River Raisin has seen increasing nutrient loads in recent years largely due to the failure of the collaborative approach taken to date. While facilities such as the Detroit wastewater treatment plant have been required to make costly investments in their combined sewage overflow controls, recent questions have been raised about the key phosphorus sources in the Detroit River watershed. While EGLE's efforts have primarily focused on large wastewater treatment plants in the watershed, a recent study released by the University of Michigan raised concerns that phosphorus entering the Detroit River from Lake Huron may be substantially higher than previously estimated.

Despite this lack of progress, EGLE's Integrated Report proposes to continue with its existing process and to re-evaluate whether a TMDL is necessary for nutrient pollution in the western basin of Lake Erie in 2022. Additionally, even though EGLE has designated Lake Erie as an impaired water body due to nutrient pollution and expresses in its Integrated Report that addressing the issue is a high priority, they nonetheless still assign a low priority to creating a TMDL. It's unclear how EGLE can square its statements in its Integrated Report with the designation in Appendix C. While EGLE has not committed to developing a TMDL, it has also not proposed an alternative for a TMDL.

EGLE must clearly describe its plan for addressing the current shortcomings in its collaborative process for addressing nutrient pollution in Lake Erie, as well as it plan for either developing a TMDL or an EPA-approved alternative to a TMDL. Addressing nutrient pollution and the resultant cyanobacteria blooms in Lake Erie is an urgent problem. As such, we urge EGLE to commit to developing a TMDL in this Integrated Report. At the very least, EGLE should commit to working with the EPA to develop a TMDL alternative as well as a schedule for developing a TMDL if the alternative is not effective.

Saginaw Bay

The Integrated Report suggests that nearshore organic matter buildup in Saginaw Bay is due to interactions with, among other factors, exotic mussels, and not necessarily excessive nutrient loading. Similar to the Western Basin of Lake Erie, the impact of nutrient cycling dynamics caused by mussels is often more complex than the Department suggests. We are discouraged that the Department continues to point at mussels while seemingly downplaying the obvious, and well documented, nutrient loading from agriculture in the Basin. Specific to monitoring, what is the Department's timeline to fill data gaps for shoreline and open water monitoring of Saginaw Bay which the report acknowledges is lacking? This information is obviously critical in a region that suffers from persistent organic matter and algae production.

We appreciate the opportunity to comment on the Draft 2020 Integrated Report. Please feel free to contact us with any follow up questions or concerns based on our comments.

Best,

Tom Zimnicki
Program Director, Michigan Environmental Council

Nick Leonard
Executive Director, Great Lakes Environmental Law Center

Appendix E

Comment 2:

Kevin Goodwin, GoodwinK@Michigan.gov
Michigan Department of Environment, Great Lakes, and Energy
Water Resources Division

Kevin,

We appreciate the opportunity to comment on the Draft 2020 Integrated Report.

We strongly support the Water Resources Division plan to identify meaningful and measurable environmental outcomes that will guide a program of wetland protection and restoration. This would be very useful to the efforts of Healthy Pine River (healthypineriver.org). The Upper Pine River Watershed Management Plan, December 2019, EGLE Tracking code: 2017-0102, “Figure 10.2 Priority Wetland Restoration Sites”, identifies a significant land area that, if even partially restored to wetlands, would reduce the agricultural runoff burden in our watershed. Knowing how much a wetland restoration can help restore the health of the Pine River could be an important addition to conservation easements in persuading property owners to participate.

David Shepherd, dcshepherd@yahoo.com, 989-576-2525
Member, Board of Directors
Healthy Pine River (healthypineriver.org)
Alma, MI 48801